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AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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Forty-Eight Inch Car-Wheel Boring Machine.

We illustrate on this page a 48-inch car-wheel boring machine, made by William B. Bement & Son, Philadelphia.

The frame has the general outline used for many years by this firm for machines of this class, and is unusually strong.

The bearing of the revolving table is made in the form of the Schiele curve; two such parts of one continuous curve being combined as will give the required vertical and lateral support, and at the same time maintain their unformity of bearing.

The three chuck jaws are concentrically tightened upon the wheel by a single movement of a lever, and are quickly adjustable to wheels of any diameter not exceeding 43 inches on the tread.

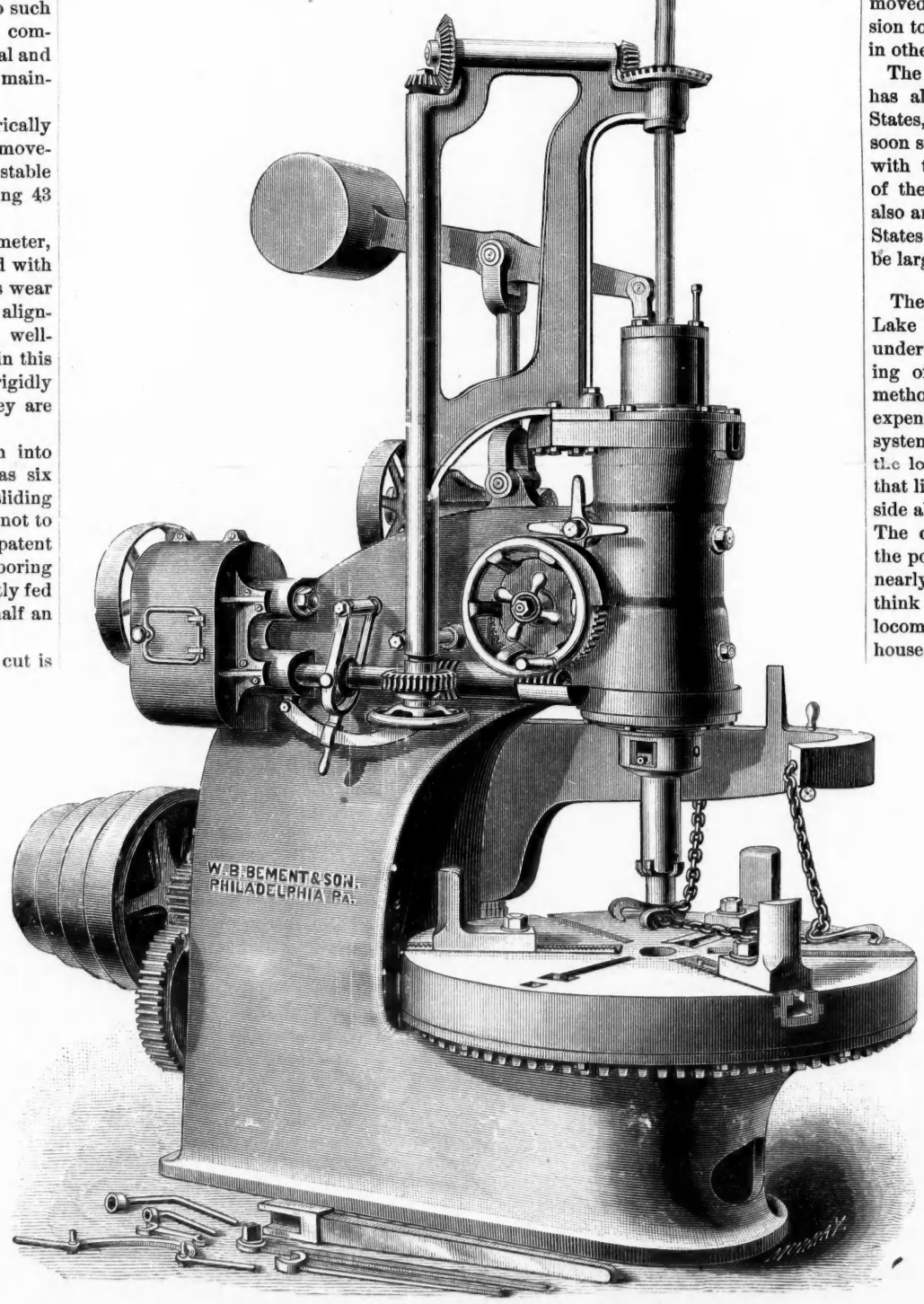
The boring spindle is of large diameter, hollow, counterbalanced, and provided with quick and easy hand movement. Its wear is compensated for, and its accurate alignment preserved, by the use of the well-known split conical bushings, which in this case have large surfaces and can be rigidly clamped in any position to which they are adjusted.

The vertical boring feed is thrown into gear by a conical friction, and has six changes which are operated by a sliding clutch-pin; a device so long in use as not to need explanation. L. R. Faught's patent quadruple cutter is much used as a boring tool in these machines, and is frequently fed through a finishing cut at the rate of half an inch per revolution.

The hub-facing device shown in the cut is also one patented by Mr. Faught. A slide which carries the facing tool receives a surfacing feed from a vertical shaft which passes centrally through the boring spindle and may be actuated either by hand or by power. A gauge screw is provided, by means of which the facing cutter can be brought into the same position for any number of wheels successively.

The wheels are raised and lowered by a vertical screw, which is caused to revolve rapidly in either direction by the movement of a lever, and upon which the crane arm is threaded and can be swung to any required position. The wheel is caught by hooks fitting the flange and raised to the proper height. It is then swung inward until the crane arm strikes a stop, when the wheel is centrally over the table, and can be lowered vertically into the chuck, no pushing or sliding being required.

These machines, when managed with a very moderate amount of skill, are capable of producing accurate and uniform work with great rapidity.



FORTY-EIGHT INCH CAR WHEEL BORING MACHINE.

Relics Belonging to a Pioneer American Locomotive.

In the blacksmith shop of New York Central's mechanical headquarters there hangs a pair of wheels that attract but little attention, yet they are interesting and valuable relics of early railroad machinery. They are the wheels of the "De Witt Clinton," the first locomotive owned by what is now the New York Central & Hudson River Railroad, and the first railroad locomotive operated in the State of New York. The "De Witt Clinton" was built by the West Point Foundry Company, New York, in the beginning of 1831, from designs furnished by John B. Jarvis, Chief Engineer of the Mohawk & Hudson Railroad, and made the first experimental trip on the road in July, 1831. The engine had two cylinders 5½x16 inches, which were set behind the fire box on an incline of about 40 degrees. The engine rested on four wheels connected, 4 feet 6 inches diameter. From an inspection of the wheels at West Albany, we found the spokes were wrought iron, fastened in cast iron hubs and an outer ring of wrought iron.

This was not the first locomotive built in America for railroad service, but she was the earliest of which any portion has been preserved. Baldwin's people preserve with great care some parts of the "Old Ironsides," the first locomotive built by Matthias Baldwin, but that engine was not built for a year after the "De Witt Clinton" was in service. Mr. Buchanan, Superintendent of Motive Power of the New York Central Railroad, talks of mounting the wheels on an axle and placing them in a position where they can be readily seen.

Leading newspapers at the South are urging upon the people the necessity of establishing technical schools, in which the training shall be such that young men may leave them prepared to earn a living, and so help build up manufacture.

One of the Southern States has already moved in the matter by sending a commission to examine the working of such schools in other parts of the country.

The fact that pig iron, made in the South, has already found its way into Northern States, indicates that the South will not only soon supply itself with iron, but will compete with those States that have furnished most of the iron used in the country. There is also an abundance of timber in the Southern States, and furniture will undoubtedly soon be largely manufactured there.

The new management of the New York, Lake Erie & Western Railroad, which have undertaken to regenerate the financial standing of the company through the logical method of increasing income and decreasing expenses, have started out by arranging a system of long runs for the train men. All the locomotives belonging to this company that lie over at the New York end stand outside all the time and have done so for years. The company's management have followed the policy of keeping their rolling stock in nearly even temperature. They did think it was conducive to the [illegible] locomotive to take it out of a warm house on a cold stormy night to [illegible] into the unsheltered cold, they permitted it to stand where the cold searching winds that rake the valley of the Hudson could keep it down to the temperature of fast running in cold weather. There is no indication of the new management changing the policy in this respect, which annually devours an immense pile of expensive coal.

English iron and steel makers thought they saw in the agitation in that country for an increase of the Navy some hopes of improving their business, which is in a very unsatisfactory condition. To this end they are said to have encouraged the agitation by all legitimate means. Now that enormous appropriations have been made for the purpose named, it has been discovered that the officials have been in negotiation with leading French and German steel makers, on the ground that they manufactured a better quality of steel than was made in England.

In working steam engineering up towards the condition of a science, practice has for the past fifty years been constantly correcting the deductions of theory. Unforeseen elements are constantly met with in practice that have neutralized and modified apparent facts. The gain from expansion has been found to have been greatly overestimated, and the results that were reasonably expected from high pressure have not obtained. Patient

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practical research, with many failures, must be depended upon to further improve the steam engine.

Power Needed in Operating the Cable Road on Brooklyn Bridge.

BY A. H. MATHESIUS, M. E.

Taking the cable road on the New York and Brooklyn Bridge for an illustration, it will be found that the cars are drawn across with about half the power that would be necessary for any other system.

The Bridge cable road is provided with two 26″×48″ steam engines that are run with a piston speed of about 480 feet per minute, and are fitted with clutch couplings for the purpose of using one or the other as condition requires. The boiler pressure is carried at about 70 lbs., and the initial pressure in the cylinder is 60 lbs. One engine is found to be ample for all the work called upon, and would be more than sufficient, if the work was more evenly distributed. As it is, the variation of power in an interval of one minute is over 200 horse-power. The cable system is best suited for small, single cars, and, if the travel demands, they may be dispatched as often as desired. By such a method the variation of power will not be so great if one or two cars are released from the cable at the same time, or if it happens that there are a few more cars on one side of a summit than on the other. It ought to be a rule, that the steeper the grade, the smaller the cars. If this rule is neglected there is danger that the cars will run away with the machinery. It approaches this condition on the bridge at present, and certainly will do it if the intention of running four cars in a train is carried out. The reason why the system of running trains instead of single cars on the bridge is adopted is, that when there are more than one grip attached to the cable they can be more relied upon, and also that the peculiar construction of the grip in use is not suited to be drawn around the curve on the Brooklyn station. On this account it is necessary to employ locomotives for switching, and as the distance over which this switching is done is several hundred feet, it requires about two minutes for the locomotives to switch the cars from the [illegible] where they are unloaded to the other [illegible] they are attached to the cable. [illegible]e grip single cars can be dispatched as they are loaded.

[illegible] part of the bridge over which the cars are drawn by cable is about 5,600 feet long. The grade 3¼ per cent. The speed of the cable is a little over 10 miles per hour, which is about 900 feet per minute. The two cars which are connected in a train, weigh 10 and 8 tons respectively, and when loaded the average weight of a train will be about 26 tons. At two minute intervals three trains will constantly be attached to the cable on each track, which makes six trains in the circuit. The total weight of the six trains is about 156 tons; and, if the maximum car axle and rail friction is taken as 1 per cent. it will require a tension on the cable of 3,120 lbs. from this cause alone. The grade upon which the cars rest is 3¼ per cent.; the total weight which is suspended by the cable and rests on the carrying sheaves is about the thirtieth part of 156 tons, or 10 400 lbs. The carrying sheaves are 15 inches in diameter, and their journals 1 inch, consequently the leverage is 1 to 15. If the journal friction is taken as 10 per cent., the power to overcome the journal friction from the weight of 10,400 pounds on the sheaves will be the 150th part, or about 70 pounds. When the trains are dispatched at two minute intervals it locates them 1,800 feet apart; the summit of the bridge being about 2,800 feet from the starting point, every other minute will bring two trains on one side and one train on the other side of the summit. This being the case on both tracks it will throw two unbalanced trains against or in favor of the power; if against the power the tension on the cable of 52 tons on a grade of 3¼ per cent. has to be added to the above resistance, which is 3,466 pounds. The friction of these two unbalanced trains has been added to the above for the reason that it is a constant whether in favor of or against the power. Then 3,466 pounds added to the total friction of 3,190 pounds gives a tension on the cable of 6,656 pounds. To this must be added the journal friction of about 200 pounds on the driving machinery which is caused by this tension independent of moving itself and cable. The total of these resistances is then 6,856 pounds moved with a volocity of 900 feet per minute, which is equal to about 214 horse-power. If the two unbalanced trains are on the side of the summit to favor the power the tension of 3.466 pounds must be subtracted from the 3.190 pounds of frictional resistances, and the difference subtracted from the power to propel the machinery and cable.

Indicator cards which have been taken under the above conditions show that the maximum power exerted by the engines is about 270 horse-power (Fig. 1). It appears then that 56 horse-power are required to drive the machinery and cable which is about 20 per cent. of the total power exerted. The minimum power shown by another indicator card (Fig. 2), is 54 horse-power, or two horse-power less than that necessary

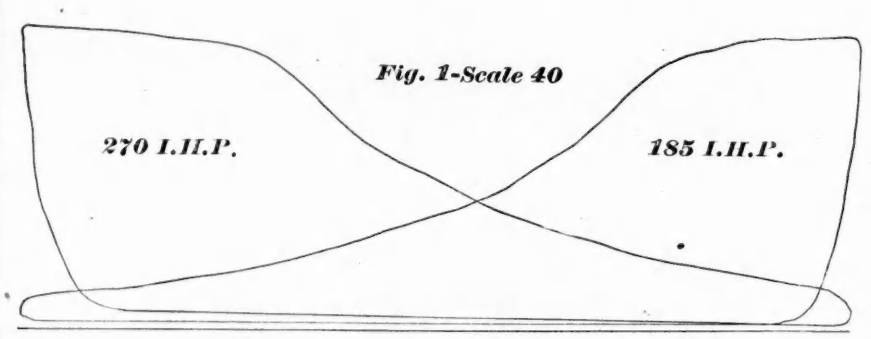


Fig. 1-Scale 40

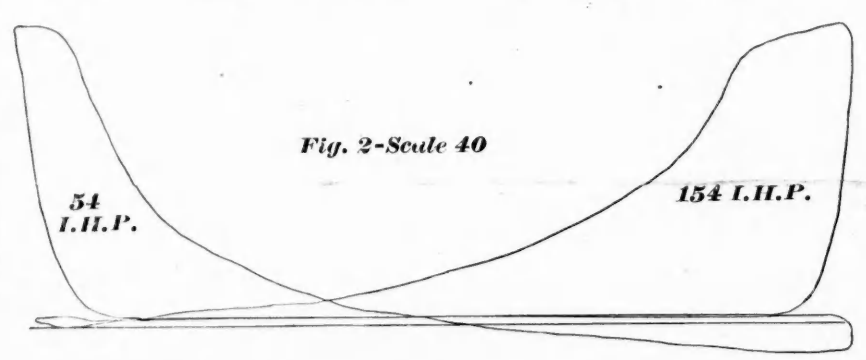


Fig. 2-Scale 40

to drive machinery and cable. It will be noticed by the above figures that the trains exert a tension of 3,416 lbs. on the cable; while all the resistances caused by friction of the cars outside of the driving machinery was 3,190 lbs., a difference of 276 lbs. equal to about 7 horse-power. By my calculation it would require only a maximum of 265 horse-power, where it indicates 270 horse-power, and a minimum of 49 horse-power, while it indicates 54 horse-power.

I pointed out at the beginning of this article that if four car trains were to be run on the bridge and distributed as they now are, they would run away with the machinery. I think that the conclusion which one draws from the diagram of the indicator card of the minimum power points that way.

The average power to draw the six trains will be the mean of 270 and 54 horse-power, which is 162 horse-power. The coal account in the bridge engine room shows a maximum consumption of about 4.000 lbs. in 8 hours, which is 500 lbs. per hour, and about 3 lbs. per hour for each horse-power. What other system will do this work with this expenditure of power?

The inclined plane on the Pennsylvania Railroad, at Pittsburgh, is a gigantic engineering structure of its kind, built according to the most advanced scientific designs, and without regard to cost. Teams, freight, and passenger cars are hauled up by means of steel cables, the plane having a total length of 840 feet, with a rise of nearly forty-three feet to the hundred. It is built on arches, the longest span being 232 feet, another is 120 feet, and the rest are sixty feet each. The cables for hauling the cars are entirely of steel, and the largest ever made in this country. The engines furnishing the motive power are of 700 indicated horse-power.

Early Railways.

In a paper read before a meeting of the Amalgamated Society of Railway Servants of Great Britain, Mr. Clement E. Stretton, C. E., an honorary member traced the growth of British railways from 1630 to 1830. About the former year a Mr. Beaumont took the lead in a movement to facilitate the conveyance of coal from the mines to the points of shipment by means of wooden ways consisting of cross sleepers placed about two feet apart upon which were nailed wooden planks or rails six feet long and about four inches wide. This pioneer of progress also introduced four wheel wagons to run on the wooden ways instead of the ordinary two wheel carts. Like most men, however, who attempted to make innovations on British methods, Beaumont lost his fortune in the attempt, and emerged from his reforming schemes reduced to poverty. Although the inventor of wooden ways obtained only loss and annoyance from his improvement of transportation facilities his invention outlived him and was improved by being covered with sheet iron to prevent the attrition caused by the iron shod wheels. This was "plating" the rails from which the word platelayer comes, the appellation still borne by all trackmen in Britain. The transition from plated wooden rails to rails made of cast iron was easy and natural where iron working was developing. The rails for 150 years after this form of track was first tried were flanged so as to keep a vehicle with plain wheels on the track.

One of the greatest improvements was introduced, 1789, by Mr. William Jessop, when constructing a railroad at Loughborough, in Leicestershire. This engineer decided to abandon the flat wheels and flanged rails, and to introduce iron rails with a flat top, and wheels with a flange cast upon the tire. Mr. Jessop's rail was known as the "edge rail," because the wheels ran upon the upper edge. These rails were of cast iron three feet long, having a single head one and three-quarter inch wide; they were of the "fish belly" pattern, that is deeper in the centre than at the ends, it being considered that it combined the greatest strength with the least expenditure of material; they were fastened to cross sleepers by iron pins or bolts passing through a projecting base cast at the ends of the rails. It was soon found that the cast-iron projections were broken off, and the rails rendered useless, as there was then no way of fastening them: this led to a great and important improvement. The base was removed from the rail itself, and cast as a separate "chair or pedestal;" the plan of bolting the chair to the sleeper, and fastening the rail by means of a key driven between it and the chair is in use to this day.

The long-wrought iron rail was first introduced about the beginning of this century and gradually pushedout its cast iron predecessor.

There can be no doubt that the usual width of the old wooden and cast-iron tramroads practically determined the gauge of our present railways. The usual width or gauge of these old tramroads was *five feet* over all, that is including the width of the two rails, and, as Jessop's edge rails and the Killingworth tramroad had rails one and three-quarter inch wide, it is easy to see that the width of two such rails deducted from five feet leaves four feet eight and one-half inches between the rails, or what we now consider the national gauge. George Stephenson saw no reason to alter the gauge, therefore he adopted four feet eight and one-half inches for the Stockton and Darlington and the Liverpool and Manchester Railways, and when consulted as to the gauge for the Leicester and Swannington, and the Canterbury and Whitstable Railways, he replied, "Makthem of the same width, though they may be a long way apart now depend upon it they will be joined together some day." The "fish belly" rails, fifteen feet long, were adopted for all these lines.

Scraps—No. 2.

BY J. G. TRAMIS.

Assuming that it is a desirable thing for a large proportion of the people of any community to know how to earn their own living, and knowing that a large number of our boys and girls are constantly seeking, unsuccessfully, opportunities to learn trades, the conclusion at once presents itself that either our schools or our industries are not conducted for the best interest of the people.

The reason our industries do not employ more apprentices may be in some instances because of trade's union influence, but in the main it is due to the simple fact that it does not pay, and with this barrier in the way there is no improvement possible except in a change in, or addition to, our present public school system.

The addition of technical or mechanical branches to our higher educational institutions does not apply to the question at all. Whatever may be the original intention, they, from necessity, drift into higher aspirations than that of making mechanics, business men, or trades people, and burden themselves with that which would kill the work of a training school, and that which is a great hindrance to every technical school, doing its best work, viz: *the establishment of a system of examinations and the granting of degrees.* Whatever comprehensive idea the student may entertain of the worthlessness of a diploma, and the value of what he learns when he enters a college or university, the importance of passing the examinations soon overshadows the value of the knowledge gained, and long before the end of his college course the importance of gaining his diploma obliterates every other thought.

The technical branches added to the educational departments, or a purely technical institute partakes, of the character of a college, conforms to college thought and is in general a college with a technical or mechanical attachment. These things are all right in their way, but there are enough of their kind already in this country, and in no way can they benefit the army of young people, who most of all need the opportunities to acquire skill, and that training in the paths of industry, which will render them independent citzens.

That industrial training be introduced into our public schools is no new suggestion, and it may be the only thing that can or ever will be done, but that is not the best thing that could be done, because it is beginning to deal with the subject at the wrong end. The practical training is attached to, and is sure to be made subordinate to the intellectual. The instructors' training in the normal schools is sure to be so steeped in the fancied importance of the standard branches

of education as to rapidily volatilize the best of practical intentions.

However high the intellectual development of a community; however extensive or extended their educational standing, there must be a large majority of its individual member sartisans and employes, and it is to the proper education of this class that the public schools should be directed. The work to be produced should be the objective point; the workshop and the tools should be the foundation, and to these should be added such intellectual branches, and only such branches, as tend to assist in their grandest accomplishment. It would not be a very difficult matter to arrange the book instruction so as to suit nearly all classes of industry, provided too much is not attempted. The book man will say that you should give each man a thorough knowledge of the material he uses, and so assume that the wagonmaker should know the botany, the history and properties of an oak tree, and overlook the fact that a boy will learn more of the properties of an oak block by a day's work on it with a mallet and chisel than he can from all the books ever published. If he can make the thing he wants to make, and make it well, he is in that educated; if he does it but ill, he needs training. If in the training he can receive aid from books, then give him the books; if not, then the books should go into other hands.

We frequently hear the suggestion made that what this country needs is the introduction of the German, or some other foreign system. But that is not necessary. If we have not the talent necessary to devise a system of our own, we have not talent enough to make much of a success of any foreign system. In fact too much stress is laid on the system, and too little thought of the man. No eminently successful teacher ever worked on any man's plan but his own.

The student leaving an industrial school should never be buoyed up by false hopes in the shape of a certificate or diploma. Let him go into the world with the understanding that he is to make his own way, and depend upon himself for a living.

Improved Punches.

We present on this page engravings of two improved punches, made by Hilles & Jones, Wilmington, Del.

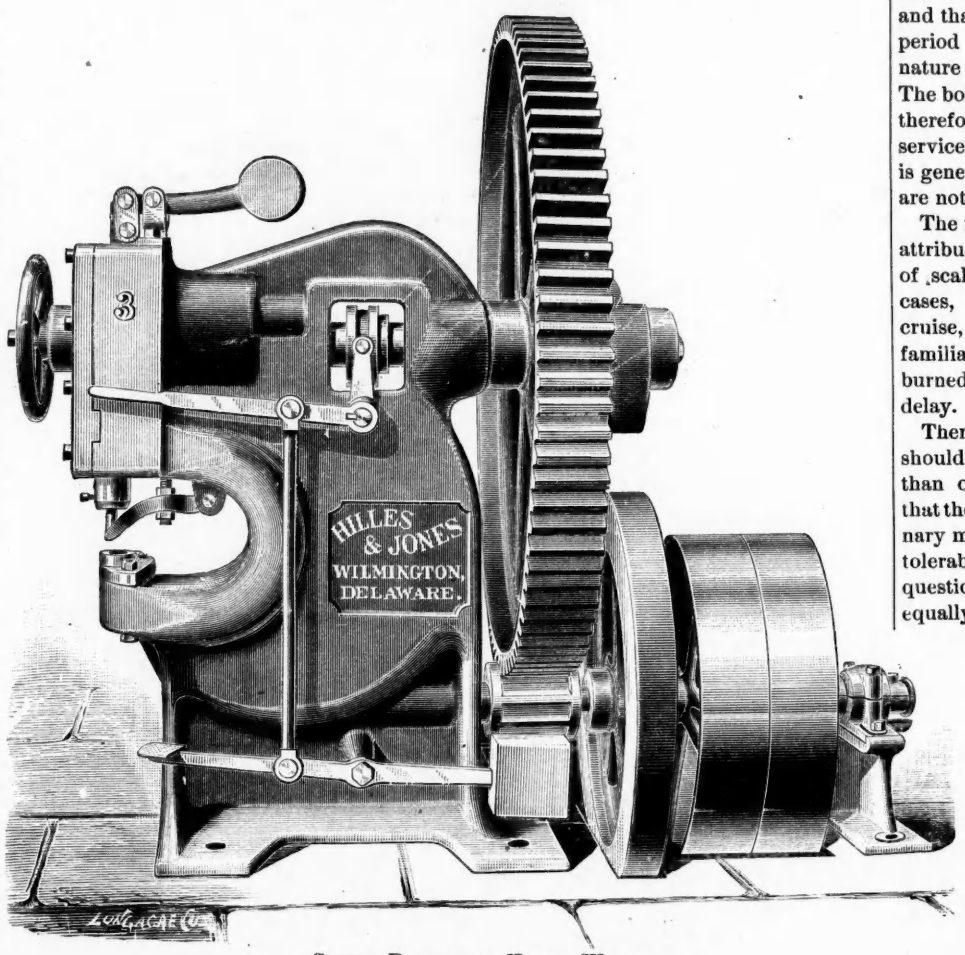
The horizontal flange punch for boiler makers' or bridge builder's use, possesses advantages that will be readily seen. The gearing and driving mechanism being all below the punch, leaves the top of the machine free for handling work of any shape, so that flanges of all forms, or bent angle iron, may be punched from either the outside or inside, as may be desired.

A counterweight is provided, which draws the punch back when the clutch is thrown out.

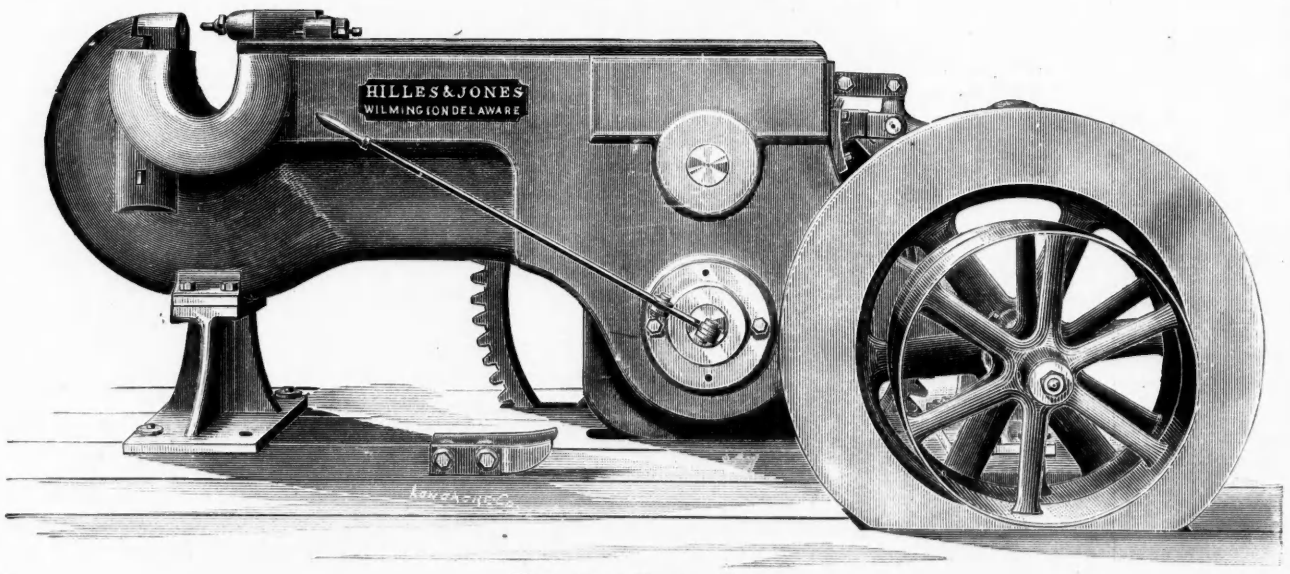
The single vertical punch is designed for heavy work. The large spur wheel runs close to the bearing, the clutch being outside. This reduces the effect of "overhang" on the bearing to a minimum.

When desired, this machine can be furnished to serve as a shear as well as a punch, by the substitution of knife blocks.

Both these machines are massive, with metal well distributed, and are capable of doing heavy work without risk of breakage. They are made with any depth of jaw or throat required, up to 48 inches.



SINGLE PUNCH FOR HEAVY WORK.



HORIZONTAL FLANGE PUNCH.

It has now been definitely settled that Paris is to have a Universal Exhibition of Industrial Produce in 1889, to which the products of all nations will be admitted. A committee of thirty-three members has been appointed by the French Government, which is to devise the means of securing the success of the exhibition. The president of the committee is M. A. Proust, deputy and former "Ministre des Beaux Arts," while M. M. Teisserenc de Bort, senator, and E Spuller, deputy, have been appointed vice-presidents. The site of this exhibition will probably be the Champ de Mars and the Trocadero, where the exhibition of 1878 was held, and in addition the Esplanade des Invalides and the Palais de l'Industrie. This would provide 400,000 square meters more space than was available for the previous Paris exhibition. It is intended to erect a vast permanent building as a memorial of the exhibition, which is at the same time to perpetuate the memory of the first revolution. The exhibition is to be opened on May 5th, 1889, that being the centenary of the opening of the "Etats Generaux" by Louis XVI. Germany has already signified her intention to take part in the exhibition, and the acceptance of England, Austria and Russia is confidently expected.

Iron and steel tires have long been used to protect wheels from wear, but there is now a proposal to adopt the appliance for a most novel purpose. As the handy greenback has never obtained favor in England, the principal money used is metallic currency. Gold coin forms an important part of the circulating medium, and it is asserted that an annual loss of $325,000 is incurred through detrition of the gold coinage. An inventive genius has patented a neat steel tire for gold coin, the ring to be shrunk on after the coin is finished; and it is reported that the Chancellor of the Exchequer is seriously considering the propriety of adopting the invention.

We wish to caution men out of employment against the deceptions of certain employment agencies in the North, who in many instances have sent workmen South with the promise that they would find work about the New Orleans Exhibition or in public works going on in other parts of the Southern States. Such men have in the greater part of cases been sent away under false pretences. There is no demand for help in New Orleans, and the local supply of attendants and workmen for the exhibits is much greater than the demand. There is little doing in the way of internal improvements in the South this winter to call for help from Northern workmen.

Further experiments have recently been made at Sandy Hook with the Haskell multicharge gun. In one of the rounds fired nineteen pounds of powder were used in the breech, and one hundred pounds distributed in the four pockets. The result was that a shot weighing 111 pounds was projected with an initial velocity of 2004 feet per second, and, with an elevation of 8½ degrees, to a distance of 6753 yards. This, it is claimed, is the greatest distance ever attained at that elevation.

Care of Boilers in the Navy.

At a recent meeting of the Naval Institute, Assistant Engineer W. M. Parks, U. S. N., read an interesting paper on "The Care of Boilers in the Navy." Mr. Parks asserted that it must be evident to any one familiar with the subject that the lifetime of boilers fitted to the vessels of our Navy is too short, and that the cost of repairs during their brief period of service is far greater than the nature of their duty would seem to warrant. The boilers are well built, of the best material, therefore maximum efficiency and length of service ought to be expected from them. It is generally conceded that these expectations are not realized.

The rapid deterioration of naval boilers is attributed to rapid and disastrous formation of scale on the heating surfaces. In some cases, before the boilers have made one cruise, they are choked up with scale. The familiar results follow: leaky tubes and burned sheets, with consequent expense and delay.

There is no reason why naval boilers should not last quite as long or even longer than ordinary marine boilers, unless it be that they are subjected to harder usage. Ordinary marine boilers, well cared for, enjoy a tolerably long life of efficient service. The question is, Why are not our naval boilers equally efficient and durable? The explanation given in Mr. Parks' paper is that a standing order to naval engineers prohibits them from using boiler water of a density exceeding $\frac{1\frac{3}{4}}{32}$ To work within this limit of concentration, an engineer has to use the blow-off cock very frequently, the waste of water being supplied from the sea. The sulphate of lime present in the sea water is then deposited on the heating surfaces. Atlantic steamers frequently make a voyage of ten days without opening a blow-off cock, but the concentration of salts in the water will often reach a density of $\frac{4}{32}$ or $\frac{5}{32}$; yet they do not deposit much scale, because the quantity of scale-making materials is dependent upon the quantity of fresh sea water fed, which is carefully restricted. Were the methods followed by well-managed merchant vessels permitted in our Navy, it is believed they would result in material saving to the nation and over supply of red tape alone, prevents the change from being made at once.

International Inventors' Exhibition at London.

The managers of the International Inventors' Exhibition, under the presidency of the Prince of Wales, which opens in London in May, 1885, are desirous that American inventions shall be well represented, and to that end have extended the time during which application for space may be made by citizens of this country to January 31. The first division, which includes apparatus, appliances, processes, and products invented or brought into use since 1862, should be of interest to American inventors and manufacturers. We believe the exhibition will afford them an excellent opportunity for showing what they are desirous of giving publicity to, and the extension of time noted will give them plenty of time to apply for space.

Balancing the Running Parts of Steam Engines.

BY FRANK H. BALL.

In reading Mr. J. C. Hoadley's article entitled, "Balancing the Running Parts of steam engines," in the AMERICAN MACHINIST of November 29th, I notice the following statement:

"It may be remarked in passing that the throw of any unbalanced rotating mass is toward the light side of the mass, and is nothing else, than the effort of the mass to revolve about an imaginary axis passing through its own center of gravity, which is one side of the rigid axis of rotation and always on the heavy side of the revolving mass, and to bring this imaginary axis to coincide with the rigid axis."

With all due deference to the opinion of Mr. Hoadley, I must beg to differ with him decidedly, and shall undertake to prove that the mass not only does not "throw toward the light side," but that there is not the slightest effort "to bring this imaginary axis to coincide with the rigid axis," in fact, quite the reverse. I have heard the theory before and must attack it as false in every particular.

Let Fig. 1 represent a wheel or disk, having a heavy side at *C*, and a light side at *D*. Suppose the center of gravity to be at *A*, and the rigid axis of rotation at *B*. Mr. Hoadley tells us that the throw of this mass will be toward *D*, the light side. In other words, that the pressure on the journal *B* due to the unbalanced condition of the mass will be toward the light side *D*. This error, I think, is the result of reasoning that, because a revolving body always revolves about its center of gravity, therefore if forced to revolve also about a rigid axis not coincident with the center of gravity, there must be an effort to bring these axes to coincide. The theory is plausible, but I think it can be demonstrated to be wholly untrue.

In Fig. 2, let the weight *W* be made to revolve around the center *C*, as indicated by an arrow. At each revolution about the center *C* it will also have made one revolution on its own center of gravity as an axis, therefore we have two distinct centers of motion, one at *C*, and the other the imaginary axis of its own center of gravity, each entirely distinct from the other, and in no way influenced by the other.

As this theory is the basis of our demonstration, let us have the idea clearly fixed before going further. To show that these motions are entirely independent, let any one stand before a post, and taking hold with the hands, pass round the post to the point of starting. Then stand by the post facing any direction, say the north, and pass round the post constantly facing the north. In both cases your body, as a mass, will have made one revolution around the post. In the first instance, you will also have made one revolution on an imaginary axis passing through the center of gravity of your body, and in the latter you will not.

We may say then that a body cannot revolve around a fixed point, having the same side of the body constantly toward the center of motion, without also revolving on an imaginary axis passing through its own center of gravity. The moon is a familiar illustration of this, in its motion around the earth. We see the same side always toward the earth, and therefore it makes one revolution about its axis, while completing one circuit in its orbit.

A rifle ball is made to rotate swiftly on its center of gravity, in addition to its flight through the air. Either of these motions could exist without the other.

With a clear understanding of these motions, let us again refer to Fig. 2. Suppose the weight *W* revolving about the center *C* be released in the position shown. Evidently it will fly off on a tangent and pass through the points W^1, W^2, W^3, etc. It may also be said that it will go on revolving about its own center of gravity, and that it will have made just one rovolution when reaching the position W^4, a distance equal to the circumference of the circle it had just left. Thus, we see that the motion of the body around the center *C* has resulted in the motion from *W* to W^4, and the rotation about its own center of gravity still goes on, quite as though nothing had happened.

A very simple illustration of this may be had by attaching a cord to a small weight of some form whose motion can be readily observed, say a bolt, and swinging it around as a boy swings a sling, let go suddenly and notice the motion. It will be seen that the bolt in flying off on a tangent is also revolving about its own center of gravity, making one revolution in the same interval of time required to swing once around before being released.

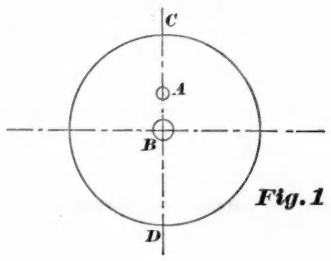


Fig. 1

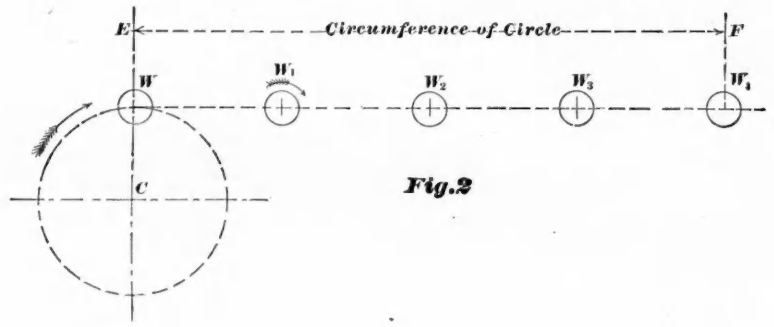


Fig. 2

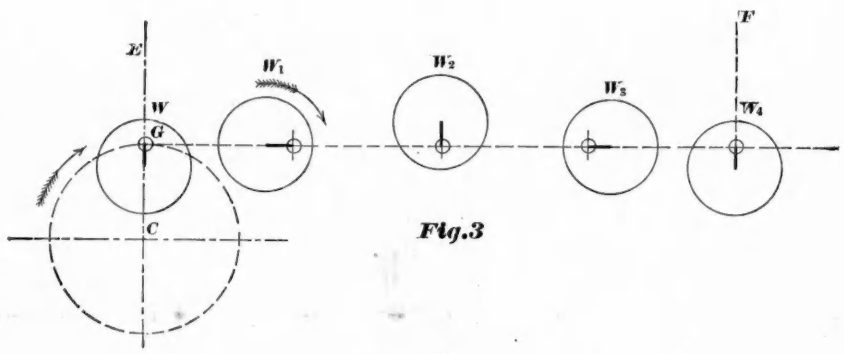


Fig. 3

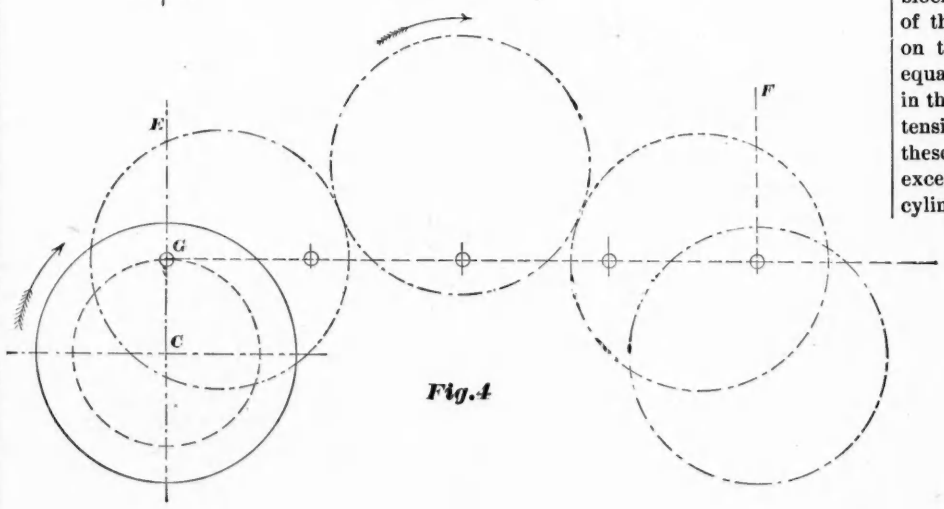


Fig. 4

Fig. 3 is another illustration of the same principle. In this case the weight *W*, has a heavy side, its center of gravity being at *G*. When released its center of gravity pursues the tangent as in Fig. 2, passing through the positions W^1, W^2, W^3, and arriving at W^4 in exactly the time previously occupied in completing one revolution around the center *C*, the distance being the same.

Fig. 4 further illustrates the same principle. The weight here has its center of gravity at *G*, and its fixed axis of rotation at *C*, which is the geometrical center of the figure. This figure we may assume to be a disk with a heavy side, and its center of gravity *G* is made to rotate about the fixed axis *C*.

If Mr. Hoadley is correct, the center of gravity *G* would seek to coincide with the rigid axis *C*. That it will not do so is evident from the foregoing. We may be sure the center of gravity will, as before, follow the same tangent, arriving as before at *F*, while making one revolution. The various positions shown by dotted lines indicate the different positions for four equal intervals of time.

If, then, it is true that the center of gravity does not seek to coincide with a rigid axis of rotation not coincident with it, why do we find that if an unbalanced rotating body be released from its fixed axis, it will generally be found to rotate soon about its center of gravity only?

Let us imagine Fig. 4 to represent a wheel revolving in a horizontal plane like the wheel of a top, and its hub resting on a level surface. Now, if the fixed axis be released, the motion of the mass on a tangent, and also its rotation about its center of gravity, will be spent in friction, the greater force outlasting the lesser. If the two centers are nearly coincident, which is generally the case with unbalanced wheels, the force on a tangent will be slight, and soon overcome by friction, leaving only the rotation about its center of gravity.

I think it has been fairly demonstrated that a mass rotating about a fixed axis also rotates about its own center of gravity, and if so, let us not say that "it *seeks* to rotate about its own center of gravity," as the expression implies a possibility of its being made not to do so, which we know can never be the case.

The counterbalancing of the running parts of steam engines, furnishes another demonstration of the error of Mr. Hoadley's theory. In Fig. 5 let *A* represent the crank disk of an engine revolving in the direction indicated by an arrow. Let *C* represent the cross-head, and *P* the piston. When the crank-pin is at *B* we see that the reciprocating parts are moving with their greatest velocity toward *G*, and at *F* they have attained their swiftest motion in the opposite direction. Therefore, while the crank-pin is moving from *B* to *F* the motion of the reciprocating parts has to be entirely overcome in one direction, and a like amount imparted in the opposite direction. The inertia of these parts during this change of motion causes a thrust or throw of the crank shaft in the direction of *G*, which is felt on the side of shaft marked *K*, causing the frame of the engine to move toward *G*. This force may be represented by the dotted line *H* and will be seen to be greatest, when the engine is on its center, at which point it is exactly equal to the centrifugal force of a mass of the same weight as the reciprocating parts, revolving with the crank-pin, and having its center of gravity at the center of crank-pin. Assuming then that the effect of inertia of the reciprocating parts of an engine in the position shown in Fig. 5 is to produce a throw of the crank-shaft in the direction of *K*, if we are to overcome this we must introduce something that will produce a simultaneous throw in the opposite direction.

Suppose we apply the counter-balance *S*. If Mr. Hoadley's theory be true, we shall only have increased the thrust at *K*, and therefore increased the difficulty. This thrust of the reciprocating parts towards *G*, if partly or wholly received by compression between the piston and cylinder head, still produces the same effect in shaking the engine, it being merely transferred from the pillow block to the cylinder head. Without inertia of the reciprocating parts the total pressure on the cylinder head in one direction is just equaled by the pressure on the pillow block in the opposte direction, resulting only in a tensile strain on the frame. The inertia of these parts has the effect of producing an excess of pressure either on pillow block or cylinder head, first in one direction and then the other, and this is what the centrifugal force of a counterbalance can be made to overcome.

Of the amount of counterbalance desirable to use, and of its effect in other directions it is not my purpose, in this article, to speak. I have simply undertaken to prove that the centrifugal force of a revolving mass is *always* away from the axis of motion, and never toward it.

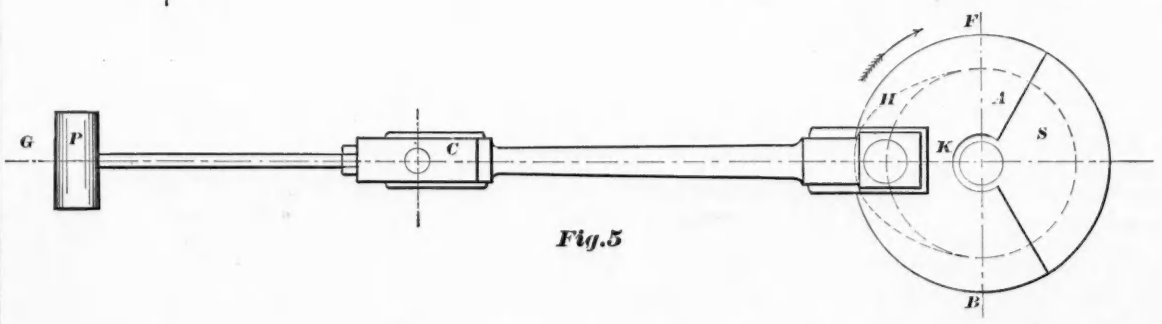


Fig. 5

Mr. Jacob Reese, Pittsburgh, Pa., has obtained a patent for a converter having a fixed metal chamber surrounded with a water-jacketed iron lining and non-metallic bottom. The converter is formed with a metallic adjustable dome having a non-metallic lining, and the air tuyere is water jacketed, special provision being made to insert and withdraw the tuyere quickly without impairing the water or the air connections.

The Commissioner of Patents having made a request that the public contribute small working models of machines for exhibition at the New Orleans Exposition, an Ohio man forwarded to the Department three grindstones weighing about 2,000 lbs. each, and was indignant at the refusal of his contributions.

LETTERS FROM PRACTICAL MEN.

Moulding a Steamboat Cylinder.

Editor American Machinist:

The engravings represent the moulding, and manner of gating, a 16″x48″ steamboat cylinder, having a 6″ sink head, making the entire length of the casting 54″. As there were a number of these cylinders to make, we made a pattern and an iron flask especially to mould them in. They are moulded in dry sand in a horizontal position, the same as any ordinary mould that is turned over after it has been dried, and the center, exhaust and port cores set. These are made of loam. The two parts of the flask are bolted together through bolt holes in flanges *A A*. The mould is then lowered into the pit and poured in an upright position, as shown in section in Fig. 1. In the back and end elevations, Figures 2 and 3, will be seen the heavy lugs *C*, by which the cylinder is bolted to the bed plate. In making the first one we only gated the casting in the lower flange, at *D*, by as large a gate as we thought would run the mould and secure a perfect casting. The iron seemed fluid enough to run hollow ware (in fact we poured off a floor of hollow ware in the same heat), but in forcing the iron up from the bottom, the upper iron became so dull, that in filling the upper lug it cold shut over the port core opposite the lug, at *B*, in Fig. 2, the iron at that point being ⅜″ thick.

In making the second one we used the same size pouring gate, 1¼″ diameter, cutting a smaller channel into the flange at *D*. We set a valve gate at *E*, Fig. 1, and cut another channel from the pouring gate into the upper lug. In starting to pour the piece we shut the upper gate off with a clay plug dried on the end of a barbed rod, as seen in section at Fig. 4. This plug is dressed to fit the extreme bottom of the gate, and blackwashed. When the iron has about reached the upper lug the plug is lifted out with a rod through the eye *F*, and by keeping the basin full, fresh hot iron is forced into the upper lug, and sound castings have been the result. ROBERT E. MASTERS.

Performance of the Coventry Boiler.

Editor American Machinist:

The Coventry boiler was in operation during the month of November, in both passenger and freight service, on the Chicago, Rock Island & Pacific Railroad, on the Chicago Division, and for the information of the railroad public, I send yon the following report of the General Master Mechanic:

"Report of performance of the Chicago Locomotive Improvement Company's Locomotive No. 60, during Nov. 1884, on the Chicago, Rock Island & Pacific Railroad, manned by the company's railroad employes:

This locomotive is an eight-wheeled, 17x24 engine, with 5-ft. drivers, mounted with the Coventry boiler.

Although the boiler is 60 inches in diameter, the locomotive rides and "curves" well.

The steam is dry and very little water is worked through the cylinders, owing to the partial superheating of the steam. She is a free steamer. She is plain, simple, strong, and free from complications.

PASSENGER SERVICE.

In 2,000 miles of suburban passenger service, although this boiler is free from netting and spark-arresting devices, it threw no sparks or cinders, and only about one-half the usual volume of smoke. She performed this service well, gave satisfaction, and was always on time.

FREIGHT SERVICE.

1,470 miles of freight service between Chicago and Peru, the locomotive hauled full average trains for this division, with the following consumption of coal: The 1,470 miles were made with 43 tons of coal, which is an average of 34⅛ miles per ton of coal, including coal burned while getting up steam and during stops. The fuel was (LaSalle) Illinois coal.

In this service the indicator was applied to the cylinders of the engine to determine the amount of back-pressure due to the extra length of the exhaust pipes, and no more back-pressure was found than in ordinary locomotives. The pyrometer was attached to the front smoke box, and it was found that from 700 to 900 deg. Fahrenheit, while working, was the temperature of the gases returned through the upper flues, with double 3⅛ nozzles, and which is always thrown away in the ordinary boiler.

(Signed), T. B. TWOMBLY,
Gen. M. M. C., R. I. & P. Ry.

N. B.—The above was heavy local freight long hours on the line.

From the official statements for the month of November, 1883—the November, 1884, reports not yet being issued—it appears that on freight service, including through as well as local trains, and with substantially the same kind of coal, the average number of miles per ton of coal used on the roads named below, respectively, was as follows:

Illinois Central—Chicago Division....	22⅜
Chicago & N. W.—Galena Division...	25⅓
Chicago & N. W.—All Divisions, including Passenger, Freight, and every kind of service.....	25⅜
Wabash, St. L. & P.—All Divisions, including Passenger, Freight, and every kind of service.....	25⅜
Chicago, R. I. & P.—Illinois Division, Freight Service, Sept. 1884, Summer month	30⅛

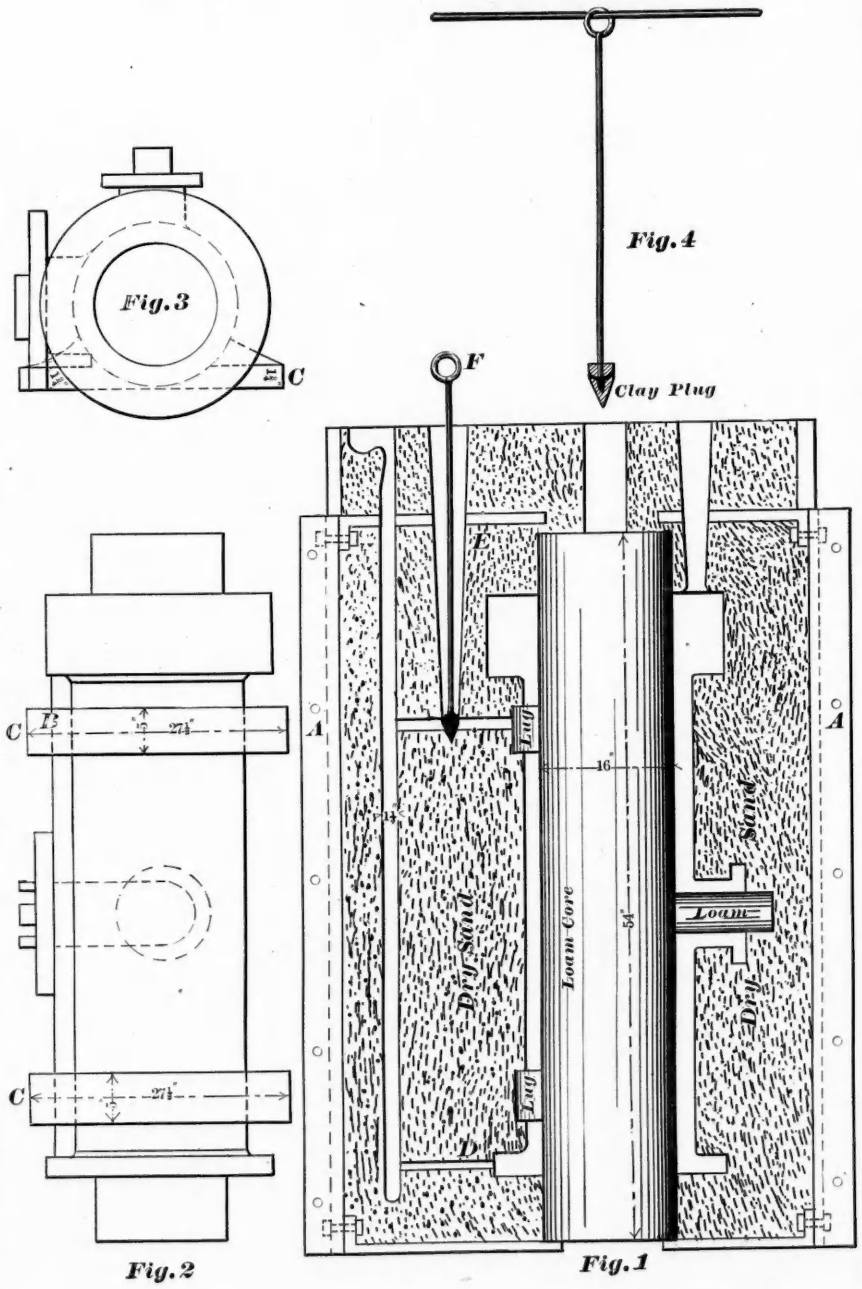
In addition to the above report of Mr. Twombly as to what our locomotive actually did, and to the reports of other railroads given above, I desire to submit:

1. That as compared with the freight record of other boilers using similar coal, she has saved not less than 13⅓ per cent in the consumption of fuel.

2. That with all things perfectly equal she will save, on the average, from 20 to 30 per cent. of fuel.

3. To hold that she is no better than other boilers is simply to ignore from 700 to 900 degrees of heat, and is to hold that the utilizing of this heat a second time is useless, and that as good results can be obtained by throwing it out of the stack to waste.

C. B. COVENTRY,
Manager Chicago Locomotive Improvement Company, 60 Honore Building, Chicago, Illinois.



Tool Dressers' Prejudice Against American Brands of Steel.

Editor American Machinist:

Referring to Mr. Goodyear's experiences in tool dressing, I think one reason why tool dressers prefer Sheffield steel is that it can be worked at a higher heat than many American brands, so that, apparently, more work can be done in a given time. Mind, I don't say more profitable work, but what better satisfies the majority of bosses and employers.

The office of tool dresser is an onerous one; that is, it is a peculiarly trying one, and requires not only a good workman, but a good *Christian* to acceptably fill it. He is supposed to please his employer, boss, and in most cases a heterogeneous community of machinists, good and bad—men who know how to use tools properly, and with whom he has no difficulty, and men who do not know how to use them, and whom it is impossible to suit. He is generally kept with his hands full. He has generally work of sufficient variety to do in an hour which, if done as he knows, properly, would require probably half an hour to prepare his fire. But suppose he does that?

Now, I cannot help thinking that "Jim" has got an exceptional position with an exceptional boss and exceptional employer, who in all probability have been in school long enough to appreciate a man who makes success the rule and not the exception, hence his boss, and the machinists, and last, but not least, his employers, bless him.

There is no doubt that excellent results can be produced from best qualities of American steel, but I cannot yet think better than with Sheffield steel, when suitably chosen material in each instance, regardless of cost, is procured and properly manipulated. But I am open to conviction, and would use the best article at the price, if it were made in Jericho. W. DICKS.

Rubber Packing for Hydraulic Presses.

Editor American Machinist:

In the AMERICAN MACHINIST of December 13th, question No. 877, J. S., Bergen Point, N. J., inquires if there is no better way to pack a hydraulic press than by leather packing. I have been using rubber packing with good results in one press with six rams, 12 inches diameter, another press seven rams 10 inches diameter; the working pressure being 1,100 lbs. to the square inch, and have tested them to 3,000 lbs. to the square inch, the packing lasting several months and worked day and night. Should one give out, it is only the work of a few minutes to put another in. The rubber must be moulded to the size; the ram must also be in proper shape to pack tightly. J. T. RIDGWAY.

Correction of Boiler Criticism.

CENTRAL PACIFIC RAILROAD,
OFFICE OF GENERAL MASTER MECHANIC,
Sacramento, Dec. 8th, 1884.

Editor American Machinist:

In the last number of the AMERICAN MACHINIST, I see you have published a cut of the boiler, blue-print of which I sent you November 11th. In my letter referring to the Coventry boiler, I notice you have omitted one word, making the criticism somewhat inexplicit where it reads: "In the case of the Coventry boiler, if it was built to burn coal, I think it would do very much better if the *large* tubes were leading from the furnace instead of from the forward connection to the smoke-arch." The word "large" does not appear in your paper. The cut of the boiler is very good, and does your paper great credit. A. J. STEVENS.

U. S. Naval Board on Tabor Indicator and Coffin Planimeter.

A board of United States Naval Engineers that recently experimented with indicators and the Coffin planimeter, report as follows: "The Tabor indicator is well and accurately made, and embodies in its design all of the best features of the latest improved instruments of other makers, excepting the ratchet stop drum, and besides it has several new and advantageous features not found in any other instrument; such as the means employed to give rectilinear motion to the pencil, thereby dispensing with the need of a parallel bar which is the most fruitful source of derangement in other instruments. The use of a duplex spring gives an equal support to opposite sides of the piston and renders a trunk guide no longer necessary. The general reduction of the weights of the moving parts consistently with their strength, thereby reducing their momentum to a minimum, makes the instrument more reliable as a measurer of power. For the reasons above given, the Board recommends that the Tabor indicator be purchased for use in the Navy Department."

Of the Coffin planimeter they say: "Tests were made with this instrument in measuring a number of geometrical figures of different forms and dimensions of known area, and its accuracy was fully established. The arrangement is simple and convenient in form, and by its use both time and labor can be saved in computing indicator diagrams and other irregular figures, and the Board therefore recommends its purchase for use in the Navy Department.

Tannekaya bark, a new agent used in tanning leather is, to some extent, imported from New Zealand, the cost of the bark there and the freight bringing the price up to about $80 per ton. It is thought that this tree would grow in the Southern States if transplanted. It is a beautiful tree of the fir species, and its timber is said to be valuable.